P/1537-206

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Thomas M. Miller et al.

Serial No.: 08/680,502 Group Art Unit: 1308

Filed: July 8, 1996 Examiner: N. McCarthy

For: METHOD FOR THE REDUCTION AND CONTROL OF THE RELEASE OF GAS AND ODORS FROM SEWAGE AND WASTE WATER

Assistant Commissioner for Patents
Washington, D.C. 20231

DECLARATION OF THOMAS M. MILLER UNDER 37 C.F.R. §1.132

Sir:

I, Thomas M. Miller, having a residence at 19826 Hidden Trail Place, Walnut, California 91789, hereby declare that:

1. I am a co-inventor named on the above-identified patent application.

2. I am Director of Business Development at PSC Technologies, Inc., a Delaware corporation, having an office and place of business at 901 East Eighth Avenue, King of Prussia, Pennsylvania 19406.

3. I have read the Office Action dated December 23, 1997 in the subject patent application in which the Examiner alleged that the claimed invention is obvious. I make this declaration in support of patentability of the claimed invention.

4. Attached to this Declaration is a statement dated February 2, 1998 of Mr. William R. Powell, Director, Water and Wastewater Department, City of Brunswick, Georgia. The February 2, 1998 account shows that the invention claimed in the subject patent application was tested by the City of Brunswick.

5. The statement describes the municipal waste water system of the City of Brunswick and the hydrogen sulfide gas problem of the system. It further describes how the claimed invention was applied to the municipal waste water system of the City of Brunswick.

6. The statement also describes a five (5) year unsuccessful quest to remedy the hydrogen sulfide gas problem in the municipal waste water system. It then describes how the invention solved the hydrogen sulfide problem, with results superior to any of the methods tested over the previous five years.

7. Also described in the statement is the initial skepticism about the claimed invention by the staff of the Water and Wastewater Department.

8. Finally, the statement indicates that the claimed method "had proved itself" to solve hydrogen sulfide gas problems; and, that the Director would urge other municipalities to use the claimed method when faced with hydrogen sulfide gas problems. Thus, the invention has proved to be a commercial success in the City of Brunswick.

9. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patents issued thereon.

3/19/98
Date

Thomas M. Miller
Thomas M. Miller

CITY OF BRUNSWICK
POST OFFICE BOX 550 • BRUNSWICK, GA 31521-0550 • (912) 267-5500

February 2, 1998

The City of Brunswick is located on the coast of the Atlantic Ocean in South Georgia and is considered A Georgia Port City. We have experienced a good mix of commercial, industrial and residential growth.

Unfortunately, with growth came hydrogen sulfide (H2S) problems. The growth areas to the northern end of town, due to long influent detention times, experience significant H2S gas problems.

One such area is Brunswick College. Approximately 9 years ago the City constructed a triplex 4 MGD repump lift station on the grounds of the College, just across from a new car dealership. As soon as the station came on line severe H2S gas problems developed. Over the years the City has received many complaints from the College, car dealership, neighboring businesses and passersby.

Approximately 5 years ago the City embarked on a quest to stop the H2S gas odor and the related corrosion to our concrete lift stations, manholes and pipes. Over this period of time we have tried a number of products that were billed as the answer to our H2S odor and corrosion problems with little or no success. Some of the products that come to mind that didn't work for us are: Calcium Nitrate, Caustic Soda, Chlorine Gas, Potassium Permanganate and 2 different varieties sulfide reducing bacteria.

In the summer of 1997, Premier Services came to us and introduced Thioguard. We had never heard of Thioguard but were willing to try something new due to our severe H2S gas problems. Thioguard is a magnesium hydroxide based product that raises the pH to approximately 8.4 to keep the sulfide in the liquid phase. Our dissolved sulfides usually ran near 6 ppm with headspace H2S levels of 550 ppm in our odor hot spots.

Thioguard shifted this balance and decreased headspace H2S by a dramatic 94%. H2S complaints downstream on lines treated with Thioguard are now gone, and the additional alkalinity provided by the product is a benefit to our treatment plant. The results are better than anything else we have tested.

Premier Services representatives came in, studied our collection system and performed baseline testing before setting up any equipment. After a short demonstration period, Premier presented a report to the City showing the effectiveness of their product. Thioguard had proved itself. Our H2S gas problems at the College are gone. Also we have suffered no additional problems downstream or at the wastewater treatment plant.

Because of our past experience with odor control products, we were initially skeptical. Although we rarely endorse products, based on our experience, I urge any municipality faced with hydrogen sulfide gas problems to seriously consider Thioguard. It is a safe, forgiving product that has eliminated our H2S problems at an affordable cost.

Sincerely,

William R. Powell, Director
Water and Wastewater Department
City of Brunswick, Georgia

Prepared for Mr. Neil McCarthy

Primary Examiner, U. S. Patent Office

2/18/98

Thioguard®

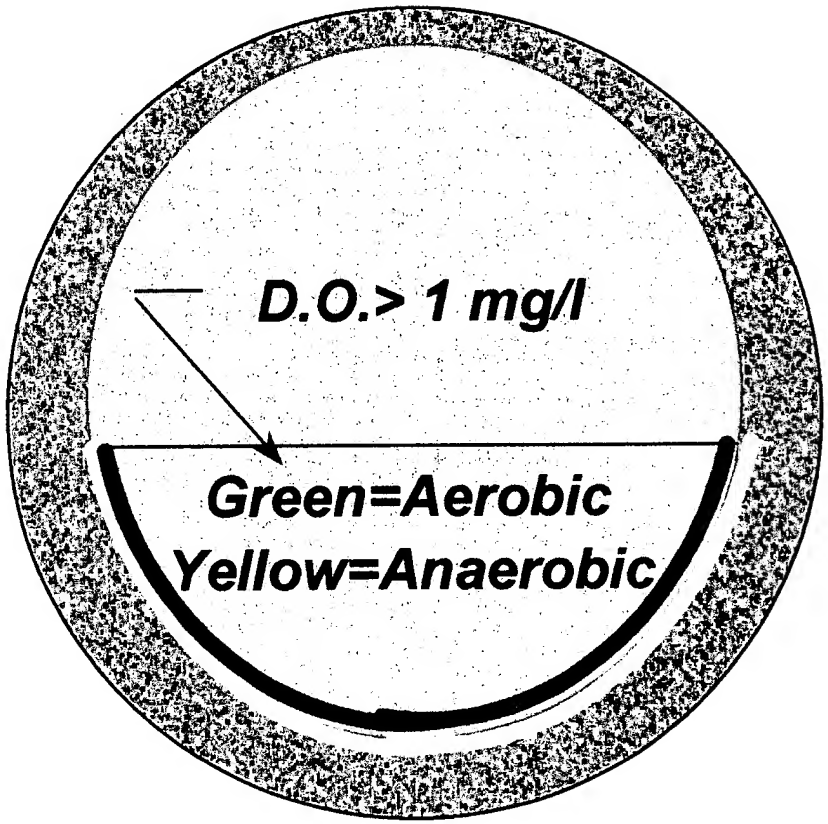
Odor and Corrosion Control

To protect the public from water borne toxic metals, the EPA enacted the 1983 Categorical Pretreatment Act.

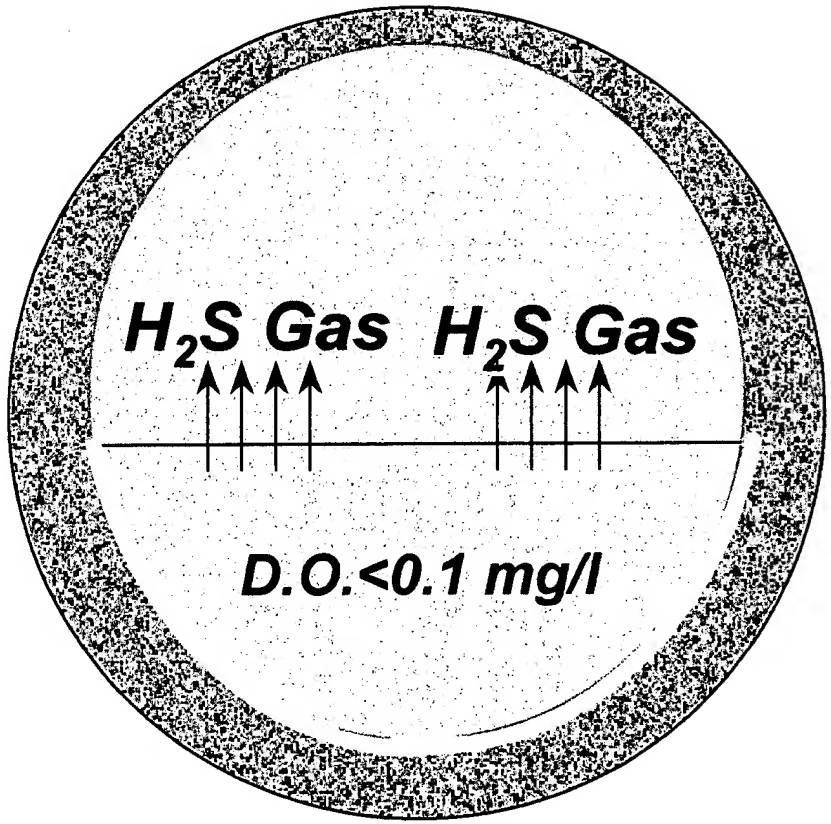
This legislation severely reduced permissible metals concentrations in industrial wastewater.

In the absence of metals, bacterial activity in sewers increases. At dissolved oxygen levels above 1 mg/l aerobes reduce organic matter via oxidation.

Very little sulfide is produced at this stage.

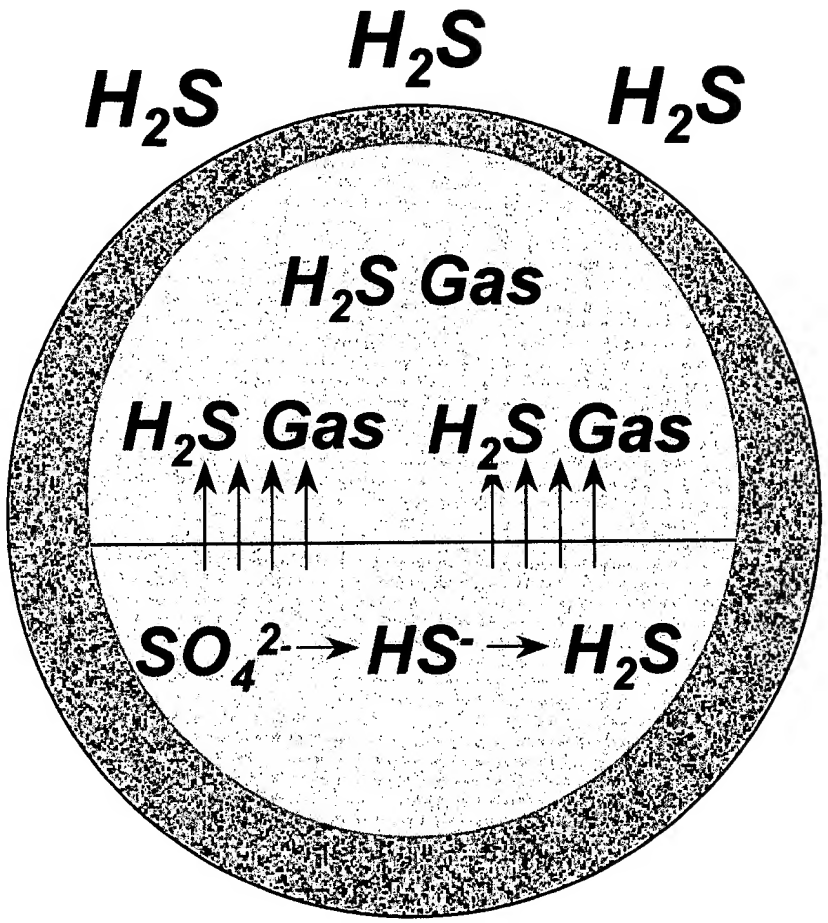


Without metals to control bacterial growth, oxygen is more quickly depleted. At <0.1 mg/l dissolved oxygen, anaerobic bacteria reduce sulfates to sulfide, which in turn volatilize to H_2S gas.

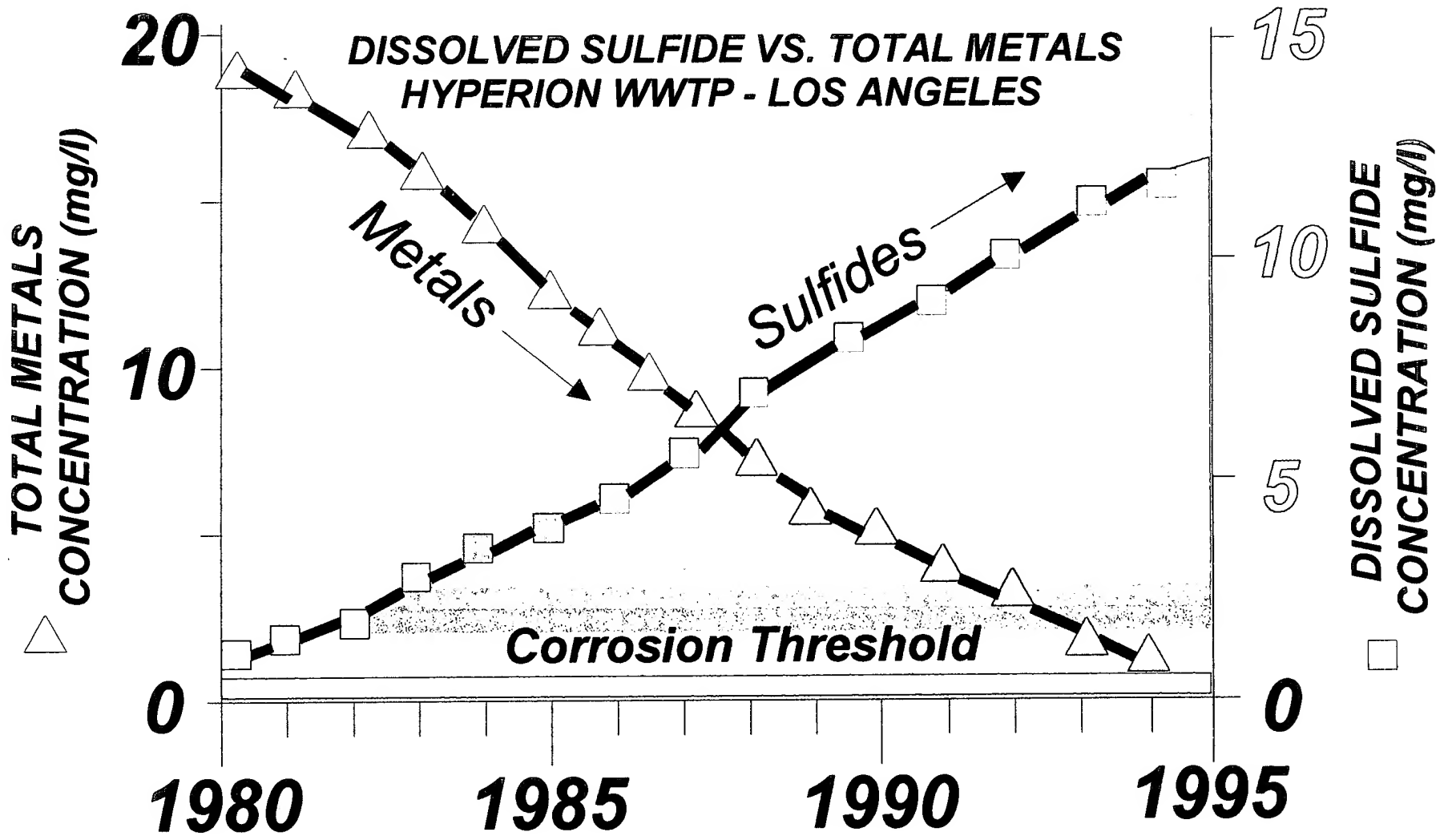


In the early 1980's, shortly following issuance of Miyanohara ('319 & '466), industry began complying with these new regulations.

The required reduction in wastewater metals caused sulfide levels to increase, triggering an unprecedented jump in H_2S gas released into the sewer headspace.



Hydrogen Sulfide Odors and Corrosion Escalated



Data courtesy of the City of L.A., CA

2/18/98

Because of this dramatic increase in H_2S production, Congress required the EPA to conduct a study and prepare a report on H_2S corrosion in wastewater systems.

The stated objectives were to determine:

The corrosive effects of H_2S in wastewater collection and treatment systems.

The extent to which uniform imposition of categorical pretreatment standards exacerbates this corrosion problem.

The range of available options to deal with such effects.

In 1991 the EPA submitted a report to Congress entitled:

"Hydrogen Sulfide Corrosion in Wastewater Collection and Treatment Systems"

Among its eight recommendations page E-6 reads:

"Applied research should be conducted on methods which offer low-cost approaches to controlling sulfide generation and hydrogen sulfide corrosion in sewers."

Due to the severity of the H_2S problem, research has been ongoing since the mid 1980's.

ASCE Manuals and Reports on Engineering Practice # 69 titled Sulfide in Wastewater Collection and Treatment Systems and many others are a result of these efforts.

During this time Dow Chemical, Davis Process Div. of U.S. Filter, Vulcan Chemicals, LACSD, Premier Services and others have developed products and technologies aimed at solving the problems associated with hydrogen sulfide odor and corrosion.

The idea of magnesia addition for H_2S control was not introduced until the inventors recently discovered its potential.

Our invention has met with commercial success.

In the 20 years since Miyanohara filed for '466, the hydrogen sulfide problem has worsened by approximately 1500%.

Yet until recently, magnesia has never been commercially demonstrated as a practical solution to the problem.

Given the severity of the H_2S problem and the number of those skilled in the art who have been searching for a practical answer, magnesia addition for H_2S control, although simple and effective, is not an obvious solution.

When added to wastewater, lime as taught by Komline is quickly spent and produces large amounts of sludge.

In practice, odor control measures generally differ between the treatment plant and the collection system.

ASCE #69 Table 11-2 page 182

Wastewater is not the same as sludge.

Collection systems handle <u>wastewater.</u>

The typical composition of untreated municipal wastewater includes settleable solids ranging from only 5 to 20 parts per million. (0.0005 to 0.002%)

ASCE #69 Table 3-2 page 23

Treatment plants handle both wastewater and sludge.

Sludge is a muddy or slushy mass of "precipitated solid matter produced by water and sewage treatment processes".

Miyanohara teaches that sludge contains 500 to 50,000 ppm (2-5% total suspended solids).

That's about 25 to 2500 times the concentration of wastewater.

Sludge as taught by Miyanohara for example, does not read on "sewage or wastewater" as instantly claimed.

Technology suitable for one, is not necessarily suitable for the other.

Miyanohara makes no claims regarding reductions in odor from the various magnesium compounds he cites.

In the absence of a strong base, magnesium chloride, magnesium carbonate, and magnesium sulfate, all taught by Miyanohara, have little or no positive impact on odors.

Also, a fundamental understanding of the odors present in wastewater and/or sludge is not demonstrated or taught by Komline.

Komline fails to teach which odors are controlled, or how. Significantly, Komline makes no reference to hydrogen sulfide gas or the parameters required to mitigate it.

Komline simply teaches when lime is added to sludge in the proper manner, and at the proper point, the odor becomes one that is "fresh" and "relatively innocuous".

The office action states:

"Komline discloses that such compounds, typically sulfur containing species and foul smelling, are present in sewage and are treated by alkaline compounds such as calcium hydroxide. Thus the addition of the magnesium compound in Miyanohara et al. will inherently have the effect of reducing odors in a manner similar to the effect of calcium hydroxide added in Komline."

Odors from municipal wastewater include many chemical compounds such as:

Acetaldehyde	*Allyl mercaptan*	*Ammonia*
Amyl mercaptan	*Benzyl mercaptan*	*n-Butyl amine*
Chlorine	*Dibutyl amine*	*Diisopropyl amine*
Dimethyl amine	*Dimethyl sulfide*	*Ethyl amine*
Ethyl mercaptan	*Hydrogen sulfide*	*Indole*
Methyl amine	*Methyl mercaptan*	*Ozone*
Phenyl mercaptan	*Propyl mercaptan*	*Pyridine*
Skatole	*Sulfur dioxide*	*Thiocresol*

Ref pg. 8 "Odor Control in Wastewater Treatment Plants"

Komline does not teach that the foul smells controlled by this art result from sulfur containing species. Foul smells from sewage and sludge result from a variety of compounds many of which do not contain sulfur or acid gas.

Komline never mentions the words sulfur, acid gas, sulfur containing compounds, hydrogen sulfide, sulfides, or any derivatives thereof.

Lacking this fundamental understanding, neither Komline nor Miyanohara can teach that adding magnesia will control hydrogen sulfide formation and release.

Operating pH for Komline and Miyanohara are both in excess of 9, with Komline being the higher of the two.

The concentrations and resulting odors produced by these technologies are substantially different. Excess ammonia is flared off in Komline compared with Miyanohara, and the reduction of organic odors caused by high pH lime breaking the hydrocarbon bonds of the organic waste are not mitigated by magnesium.

In practice, the chemical strategies taught by Komline and Miyanohara, are not effective for controlling H_2S in collection systems.

Recommended chemical measures employed to control odors in municipal wastewater collection systems include a wide range of chemicals.

Hydrogen Peroxide
Sodium Hypochlorite
Oxygen/Air Injection
Nitrates
Anthraquinone
Potassium Permanganate

Chlorine Gas
Ozone
Metal Salts
Odor Masks

Lime is not among them...

See ASCE # 69, #82, WEF Manual of Practice #22, Montgomery Watson Chemical control options.

For these reasons Komline and Miyanohara, alone or in concert, do not teach control of H_2S by addition of Magnesia to wastewater, nor do their disclosures render it obvious to those skilled in the art.